

Turner® Spectrophotometer

OPERATING MANUAL *MODEL SP-830*

Model #
SM110215
SM110210-33

Voltage
115V
230V
with European cord set

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Introduction

Congratulations on your purchase of a Turner® Spectrophotometer.

Introduction

The unit is designed to do a number of jobs within your laboratory. Please read the instructions carefully to ensure that you receive maximum benefit from it. Also, be sure to fill out and return the enclosed warranty registration card. We would like to receive the information requested, and it will help us assure you of proper warranty coverage.

Important Information

This manual contains important operating and safety information. You must carefully read and understand the contents of this manual prior to using this equipment.

Safety Information

Your Turner Spectrophotometer has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert boxes throughout the manual.

General usage

Do not use this product for anything other than its intended usage.

Theory

A spectrophotometer is primarily used to identify unknown substances and determine their concentrations. The following principles outline how this is accomplished.

Matter absorbs energy when it interacts with an energy source such as sound or light. Due to its distinctive atomic structure, each substance only absorbs energy between certain levels. Since energy is proportional to wavelength, $E = hc/\lambda$ (where h is Planck's constant, c is the speed of light, and λ is the wavelength of light), every substance has a characteristic absorption spectrum.

For example, hydrogen absorbs light at the following wavelengths in the visible region: 410.7nm, 433.8nm, 485.7nm and 657.9nm. We can verify the existence of hydrogen in an unknown sample by comparing the wavelengths it actually absorbed by the unknown sample to hydrogen's absorption spectrum.

Therefore, a device, namely your spectrophotometer, is required to measure absorption spectrums in order to identify an unknown substance. A spectrophotometer measures the amount of light absorbed at distinct wavelengths of incident light. As a result, a graph of absorbed light vs. wavelength can be plotted, as shown in Fig. 1. Such a graph can be used to identify the presence of a particular substance.

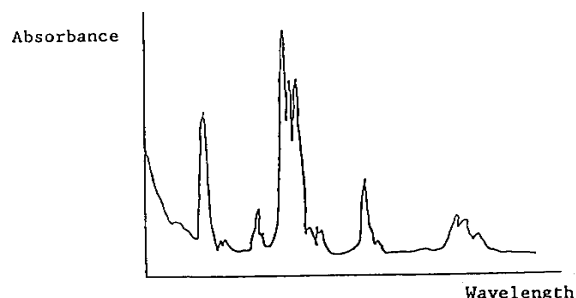


Figure 1

The *concentration* of an unknown sample can also be determined. When a light beam is incident to a sample, part is absorbed, and part is transmitted. The transmittance (T) is defined as the ratio of the transmitted intensity of the light

beam (I_t) to the initial intensity of the light beam (I_o), or $T = I_t / I_o$. The absorbance (A) is defined as

$$A = \log (1/T)$$

It is found that absorbance is directly proportional to concentration:

$$A = e b C$$

where A is the absorbance, C is the concentration (mol/l), b is the width of the sample cell or cuvette (cm), and e is a proportionality of constant called molar absorptivity (l/mol-cm).

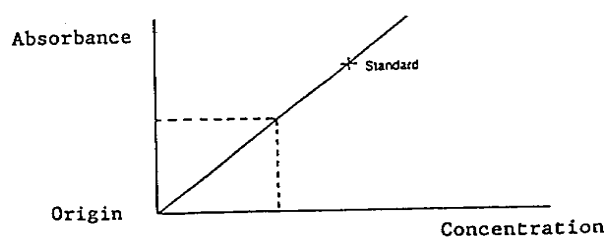
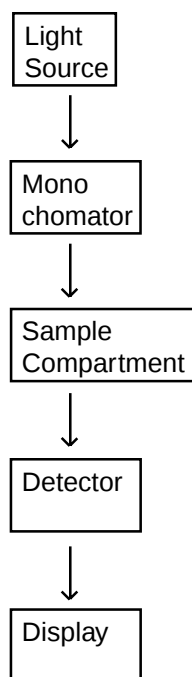


Fig. 2 Beer's Law

This linear relationship is called Beer's Law, shown in Fig. 2.



Therefore, if we have a “standard” sample with a known absorbance and concentration and a measured absorbance, it is easy to determine an unknown concentration of the same substance by applying Beer’s Law.

Working Principle

A spectrophotometer basically consists of five parts: a light source to supply electromagnetic energy, a monochromator to isolate the wavelength of interest and eliminate the unwanted second order radiation, a sample compartment to accommodate the sample solution, a detector to receive the transmitted light and convert it to electrical signal, and either a digital or analog display to indicate absorbance and transmittance. The block diagram to the right illustrates the relationship among these parts.

In your spectrophotometer, a light beam from the lamp is focused on the entrance slit and passes into the monochromator, where the collimating mirror directs the beam to the grating. The grating disperses the light beam to produce the spectrum, a portion of which is focused onto the exit slit by the collimating mirror. From here the beam is passed to a sample compartment through one of the five filters which helps eliminate unwanted second order radiation. Upon leaving the compartment, the beam is passed to the silicon diode and causes the detector to produce an electrical signal to be displayed.

Model SP-830 incorporates an A/D circuit to convert the analog signal to digital output, which is displayed by four seven-segment LEDs. It also employs microprocessor to handle the blanking, self-testing and error diagnosis.

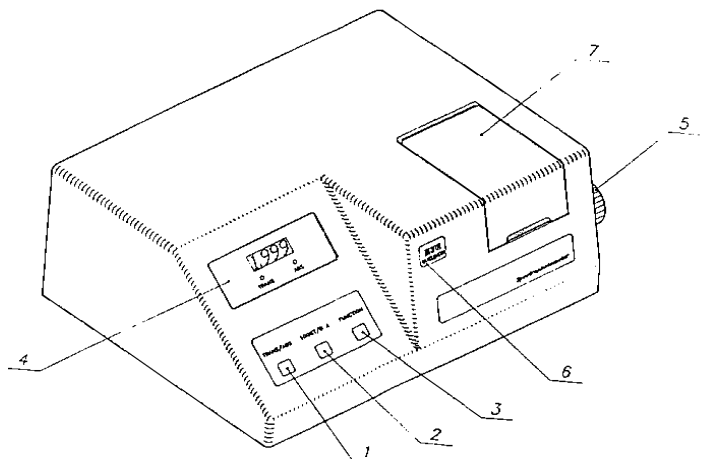
Specifications

Wavelength Range	330-999nm
Bandwidth Pass	8nm (nominal)
Wavelength Accuracy	+/- 2nm
Wavelength Repeatability	+/- 0.5nm
Wavelength Setting	Manual
Zero & Blank Setting	Automatic
Filter Selection	Manual
Display	3 1/2 Digit
Modes	
Transmittance	0-100%T
Absorbance	0-2A
Photometric Accuracy	1% at 1A
Photometric Linearity	1%
Stability	Drifting 0.003A/hr after half hour warm-up at 0A
Signal Processing	Digital, Microprocessor
Stray Light	0.1%T typical at 340nm, <0.5%T 330-999nm
Cuvettes	A. Round cuvettes 10-13mm in diameter; B. Square cuvettes 12.5 x 12.5 x 45mm, 1 cm path length (optional-34F01-04); C. Vacuum empty cuvette (optional-AYX9)
Power	115/230V ~ a.c. 50/60Hz (switchable)
Analog Output	0.00-1.00V
Interface	RS-232C, Printer (optional)
Dimension	400mm(W) x 300mm(D) x 145mm(H)
Weight	9.0kgs

Function Description

Front Panel Description

1. TRANS/ABS button
Selects between Transmittance and Absorbance modes.
2. 100%T/0A button
Sets the instrument to 100% Transmittance or zero absorbance.
3. FUNCTION button
Directs the output to RS-232C or Printer interface.
4. DISPLAY panel
Displays %T or ABS value.
5. WAVELENGTH dial
Sets the desired wavelength.
6. WAVELENGTH display
Displays the wavelength.
7. Sample Compartment
For round cuvettes or square cuvettes.

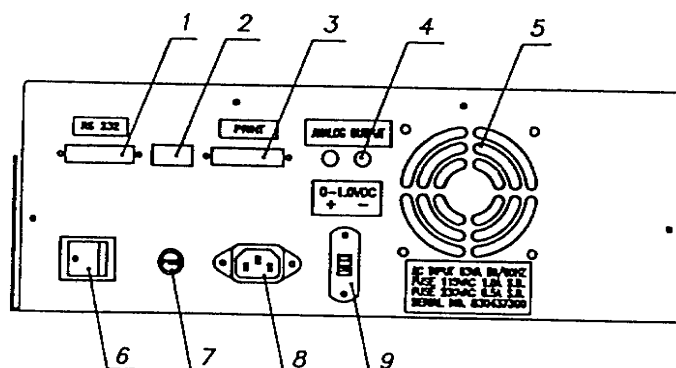


Built-in Stray Light Filter Selection

Position	Description
0	Empty (for service)
1	330-380nm
2	381-481nm
3	482-736nm
4	737-999nm
5	For calibration of wave-length (for service)

Rear Panel Description

1. RS 232-C
2. DIP switch
3. Printer (optional)
4. Analog Output
5. Fan
6. Power Switch
7. Fuse
8. Power Socket
9. 115V/230V Voltage Switch



Installation

Unpacking

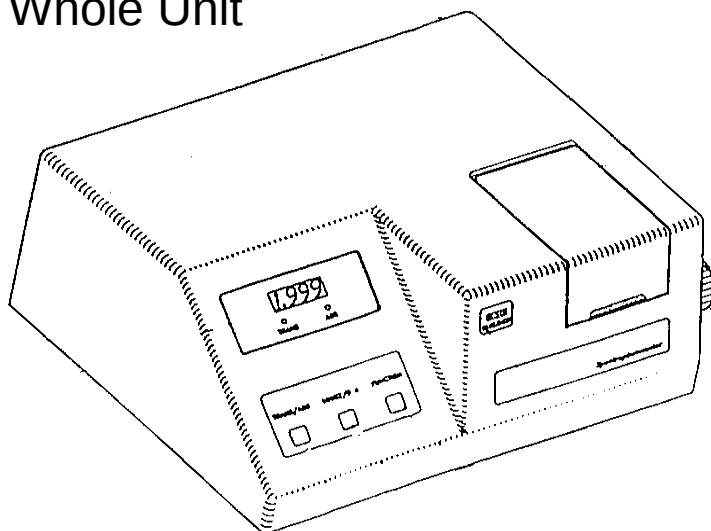
The package contains the items stated below. Unpack the carton and inspect carefully. If any part is damaged or missing, contact your dealer immediately.

Save the packing materials in case the unit may need to be repacked or returned for service.

Standard Equipment

QTY	DESCRIPTION	PART #
1	Model 830 Spectrophotometer	
	115V	SM110215
	230V	SM110210-33
1	Power cord	
	115V	CRX72
	230V	CRX70
6	Round borosilicate cuvettes	34F01-15
1	Fuse 115V/1.0 Amp	5120-0016
1	Fuse 230/0.5 Amp	FZX35
1	Operator's manual	LT1102X4

Whole Unit



Environmental Conditions

Operating: 17°C - 27°C; 20% - 80% relative humidity, non-condensing. Installation

Category II (over-voltage) in accordance with IEC 664. Pollution Degree 2 in accordance with IEC 664. Altitude limit: 2,000 meters.

Storage: -25°C - 65°C; 10% - 85% relative humidity.

Installation

1. Place the spectrophotometer on a solid and level surface in a dry, clean environment.
2. Select the correct line voltage (115V or 230V) with the selector at the rear panel. The voltage is preset at 115V.
3. Select and install the correct fuse: 1.0A for 115V (pre-installed), or 0.5A for 230V.
4. Plug the power cord, one end into a wall outlet, the other end into the outlet at the rear of the instrument.
5. Turn on the spectrophotometer and allow it to warm up for at least 20 minutes to stabilize the electronic components.

Operation

Pre-Check Procedure

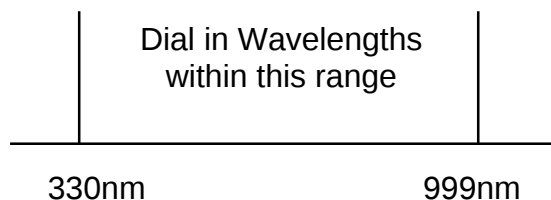
Your spectrophotometer has been fully checked and aligned before shipping. However, a short pre-check should be performed before the first use of this instrument.

1. Carefully unpack your spectrophotometer and check every item against the Standard Equipment.
2. Place the spectrophotometer on a solid and level surface in a dry, clean environment.
3. Confirm that the correct line voltage is set.
4. Plug the AC power cord into the rear of the unit and plug into a ground wall socket.
5. Turn the power ON by switching the rocker switch at the rear of the spectrophotometer.
6. Allow the spectrophotometer to warm up for at least 20 minutes to stabilize the electronic components.
7. Place the filter selector wheel inside of the sample compartment to position 1 and set the wavelength dial to 340nm. Press the 100% T/0A button. The display should show 100.0 while in the TRANS (transmittance) mode and 0.000 for the ABS (absorption) mode. Indicator lights below the main display indicate whether the unit is in the transmittance or in the absorbance mode. To change the mode setting, press the TRANS/ABS button on the front panel of the unit.

8. If the LED display shows Err-3 or Err-4, the lamp alignment may have shifted during shipment. Refer to the section entitled Re-aligning the Lamp for more information.

Wavelength Dialing

The wavelength setup of the spectrophotometer is designed to be made only in between 330nm and 999nm. Refer to the chart shown below. **Do not turn the wavelength dial above 999nm or below 330nm. Overturning the wavelength dial can cause the lead screw that controls the wavelength selection dial to be damaged.**



Operation of Model SP-830

1. Turn the power on, and allow the spectrophotometer to warm up for at least 20 minutes.
2. Fill a blank cuvette with deionized water, buffer or solvent and place it in sample compartment.
3. Turn the wavelength dial to the desired wavelength. Be sure to set the filter selector (located in the sample compartment) to the appropriate position. Close the sample compartment lid.

4. Select Transmittance or Absorbance mode by pressing the TRANS/ABS button. The display will show 100.0 in the transmittance mode or 0.000 when in the absorption mode. Carefully open the sample compartment and remove the cuvette.
5. Fill another cuvette to the same level with the test solution and put into the sample compartment. Close the sample compartment door. The transmittance or absorbance of the solution is shown on the display.
6. Repeat step 5 for more samples to be tested at the same wavelength. For different wavelengths, repeat steps 2-5.

Message Code Interpretation

If there is a problem, the LED display on your spectrophotometer will flash a message code that will indicate the type and source of the problem.

Check to make sure that the filter wheel is in the correct position before interpreting these message codes.

□□□□	Set Blank.
— — — —	Blanking procedure is taking place.
Err 0	Instrument has malfunctioned. Call for service
Err 1	Blank solution exceeds range. 1. Check blank solution. 2. Check whether wavelength and filter position match. 3. Realign the lamp.
Err 2	Light source intensity is too strong 1. Check whether wavelength and filter position match. 2. Check whether top cover is properly closed. 3. Realign the lamp.

- | | |
|-------|--|
| Err 3 | Light source intensity is too weak |
| | 1. Check whether wavelength and filter position match. |
| | 2. Realign the lamp. |
| Err 4 | Stray light is too much |
| | 1. Check whether top cover is properly closed. |
| | 2. Realign the lamp. |

If all the remedy steps fail, please call for service.

General cleaning instructions

Wipe exterior surfaces with a dampened cloth containing a mild soap solution.

Maintenance

**Caution**

Unplug your spectrophotometer before replacing the lamp.

Replacing the Lamp

1. Open the door on the left hand side of the spectrophotometer. Push and twist counter-clockwise to remove the lamp from the holder.
2. Insert the new lamp into the socket and carefully rotate clockwise until it locks into position.
3. Carefully wipe fingerprints off the lamp with a small tissue.
4. Turn the power on and perform steps 6 and 7 of the Pre-check procedures (page 12). If realignment of lamp is required, refer to the section Realigning the Lamp for more information.

Realigning the Lamp

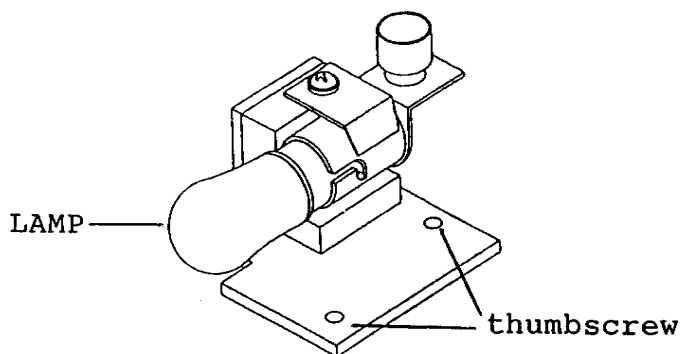
If the LED display shows an Err-3 or an Err-4, realign the lamp as follows:

1. Set the filter selector wheel at position 1, and set wavelength to 330nm.
2. Press and hold down both the TRANS/ABS and 100% T/OA buttons while switching on the power to the spectrophotometer. Then, release the buttons. This tests the LED display.
3. Press the TRANS/ABS button, F1-0 should be seen on the display followed by a three digit numerical value. If this value shown is lower than 500, continue as follows to align the lamp. If the value is higher than 500, and the code Err-3 or Err-4 is still on, call for service.

**Note**

Following is the procedure of getting into or out of function mode during the operation.

1. Press and hold TRANS/ABS button, then push FUNCTION button two times, and release the button. After the display shows the self-test cycle, push TRANS/ABS button to get into the function mode.
2. Press and hold TRANS/ABS button, then push 100%T/OA button once and release the button. After the display shows the self-test cycle, press and hold TRANS/ABS again, push 100%T/OA button once, and release the button. When the display shows $\square\square\square\square$, the instrument is out of function mode and ready for blanking.
4. Open the door on the left hand side of the spectrophotometer. Move the lamp holder forward and backward to vary the position of the lamp until the highest value (intensity of the light) is obtained. This value must be higher than 500. (Refer to the chart for the lamp holder).



5. Close the door and turn off the power.
6. Turn the power on again. Set the filter selector wheel to position 1 and set the wavelength dial to 330nm. **Do not turn the wavelength dial below 330nm or above 999nm.**
7. Press the 100%T/OA button.
8. The display should show 100.0 for TRANS mode or 0.000 for ABS mode. If so, the realignment is completed.
9. If Err-3 or Err-4 still exists, replace with a new lamp.

RS-232 and Printer

Setting

DIP Switch Setting Table

S	Functions i t c	O h	O	F Setting # a
SW1,	RS-232C ON/OFF Select	O	O	O
SW2	RS-232C Buad Rate Setting			O
SW3 F F				O
SW4				O
SW5 - \$R		7 Bits	8 Bits	O
SW6,	RS232C Parity Setting	Even	O	O
SW7	Printer ON/OFF Select	O	O	O
SW8	Printer Auto Line Feed	O	O	O

Baud Rate Setting Table

Baud Rate	SW2	SW3	SW4
9	O 6	O 0 F	O F 0
4	O 8	O 0 F	O F 0
3	O 6	O 0 F	O 0
2	O 4	O 0 F	O 0
1	O 2	O 0	O N F 0
600	O	O	O N F
300	O	O	O N
110	O	O	O N

Operation

1. Make sure the DIP switch setting is correct.
2. If not, turn off the power and reset DIP switch.
3. Make sure the connector of RS-232 or printer is well connected.
4. Press "FUNCTION" button to transmit the data.

One Year Limited Warranty

Barnstead|Thermolyne Corporation warrants that if a product manufactured by **Barnstead|Thermolyne** and sold within the continental United States or Canada proves to be defective in material or construction, **Barnstead|Thermolyne** will provide you, without charge, for a period of ninety (90) days, the labor, and a period of one (1) year, the parts, necessary to remedy any such defect. Outside the continental United States and Canada, the warranty provides, for one (1) year, the parts necessary to remedy any such defect. The warranty period shall commence either six (6) months following the date the product is sold by **Barnstead|Thermolyne** or on the date it is purchased by the original retail consumer, whichever date occurs first.

All warranty inspections and repairs must be performed by and parts obtained from an authorized **Barnstead|Thermolyne** dealer or **Barnstead|Thermolyne**. Heating elements, however, because of their susceptibility to overheating and contamination, must be returned to our factory, and if, upon inspection, it is concluded that failure is not due to excessive high temperature or contamination, warranty replacement will be provided by **Barnstead|Thermolyne**. The name of the authorized **Barnstead|Thermolyne** dealer nearest you may be obtained by calling 1-800-446-6060 or writing to:

Barnstead|Thermolyne
P.O. Box 797
2555 Kerper Boulevard
Dubuque, IA 52004-0797
USA
FAX: (319) 556-0695

Barnstead|Thermolyne's sole obligation with respect to its product shall be to repair or replace the product. Under no circumstances shall it be liable for incidental or consequential damage.

THE WARRANTY STATED HEREIN IS THE SOLE WARRANTY APPLICABLE TO **Barnstead|Thermolyne** PRODUCTS. **Barnstead|Thermolyne** EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE.

